

Original Article**Does Tunneling the Temporary Vascular Access Extend Its Lifetime?**

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**ABSTRACT**

**Background:** It is important that a reliable vascular access or dialysis catheter be available for doing replacement therapy in cases with uremia syndrome. Life time of a temporary access depends on its location; overall its life time is 2 to 3 weeks for Jugular vein. Regarding short life time of these temporary accesses, it is necessary to find a clinical way to increase the life time of such accesses. It seems that tunneling the temporary uncuffed access, prolongs its life time and reduces its complications, as well as its cost.

**Methods:** This study was a prospective clinical trial, which has been done on 30 cases with uremia syndrome without usable vascular accesses who were divided into two groups, randomly. Inclusion criteria were acute renal failure and end stage renal failure with different etiologies. All of them had got temporary vascular accesses because of their need to emergency hemodialysis. The type of used accesses, was used the same (arrow) in all cases. Patients were followed up once a week for checking the fistula or returning of kidney function in cases who had acute renal failure. Presence of inflammation, redness, pus formation, bleeding, and sutures of the entrance site were checked weekly. Life time of catheter was determined as the time of its insertion to the time of its extraction, in weeks. Data analysis was done by SPSS (version 12) and expressed by mean and variance.

**Results:** One case out of 30 selected subjects was excluded because of poor cooperation with clinicians. Thirteen females and 16 males (44.8% vs. 55.2%) were treated in two groups; the first group or tunneled group included 14 cases, and the second group, non-tunneled group, included 15 cases. Mean of age and length of neck showed no significant differences between two groups. Nine cases had fever before catheterization, however there wasn't any relationship between life time of catheter and fever in both groups ( $P=0.49$  and  $0.24$ , respectively). In this research, the most common reason for releasing the catheter in both groups was the fever due to catheter related infection, only (78.6% in tunneled group and 80.00% in non-tunneled group). Mean life time of catheter in tunneled group was  $6.71 \pm 0.9$  weeks and, in cases of non-tunneled group it was  $4.53 \pm 0.8$  weeks; this difference was statistically significant between two groups ( $p$ -value= 0.0017).

**Conclusion:** Subcutaneous tunneling the temporary vascular access can extend the lifetime of catheter and reduce its subsequent dangers and related costs due to repeated catheterization, with respect to routine method.

**Key words:** vascular access, tunneled, perm-cath

JRMS 2006; 11(1): 41-47

Vascular access and peritoneal dialysis catheter are important for renal replacement therapy in uremic patients<sup>1,2</sup>. There are two types of vascular accesses: temporary and permanent. The last type is divided into cuffed dual lumen, synthetic graft, and arterio-venous fistula (AVF). Temporary catheter is put in jugular or femoral veins of ridden by nephrologists, local<sup>3</sup>. Depending on its location, the life time of catheter varies from 2-3

weeks for jugular, to single use or 3-7 days for femoral veins in outpatients and inpatients, respectively. The chronic one is put by a surgeon in an operating room<sup>4,5</sup>. In end stage renal disease (ESRD) patients who have lost their AVF, it is necessary to put a perm-cath until their new AVF becomes ready<sup>6</sup>. In uremic patients who don't have AVF and acute renal failure (ARF), we may have to put cuffed

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dual lumen catheter or temporary one, several times. Vascular access dysfunction is an important cause of mortality and morbidity in ESRD<sup>7</sup>, and in spite of new better skin preparation and sterilization methods, infection is one of the most limiting factors<sup>3, 8, 9</sup>. Cuffed tunneled catheter decreases infection risk and prolongs its life time. It is important to note that insertion of temporary access for several times, as needed in ARF and some chronic renal failure (CRF) cases, increase not only its serious complication, but also its cost. It seems that tunneling the temporary uncuffed access prolongs its life time and this study is performed to test this hypothesis.

### Subjects and Methods

This study was a prospective clinical trial, which has been done on 30 cases with uremia syndrome without any vascular access. All of them were referred for emergency hemodialysis. After obtaining their consensuses, they were divided into two groups of tunneled and non-tunneled every other case, randomly. All the patients were either acute renal failure (ARF) or end stage renal disease (ESRD). Cases with following criteria were excluded from the study:

- Patients who were failed during catheterization,
- Patients who were admitted in ICU,
- Cases with acute pulmonary edema,
- Patients with decreased level of consciousness,
- Cases with in coagulation disturbances (platelets < 100/000, PT > 15, and PTT > 45),
- Patients whose previous accesses were failed due to infection during recent two days, and
- When AVF was get matured before 8 weeks of insertion.

In all patients, type of used accesses, was the same (arrow) and the same clinician did all the operations in similar situation. All data including age, sex, length of neck (the distance between distal edge of ear and the sterno clavicular joint), any etiologies of renal failure (such as diabetes, melitus blood pressure, polycystic kidney, glomerulonephritis, and unknown rea-

son), reason for doing hemodialysis (such as hyperkalemia, acidosis, uremic encephalopathy, hypertension, nausea and vomiting, and overload signs), body temperature, duration of operation in minutes, probably complications during operation (like entering to the carotid artery, cervical hematoma, hemothorax, and pneumothorax) were reported. Patients were followed up once a week for checking the arterio-venous fistula or returning of kidney function, in cases with acute renal failure. Presence of inflammation, redness, pus formation, bleeding, and quality of sutures of the entrance point were checked weekly. Febrile patients, with no clear cause of fever by carefully history, taking physical examination, and lab oratory and imaging studies, were treated as catheter related infection by appropriate antibiotic and then their accesses were extracted and were sent for culture and final assessment samples. Life time of catheter was determined as the time of its insertion to the time of its extraction, in weeks.

### Method of Catheterization

At first, patients were laid supine, in trendelenberg position while a pillow was supporting their shoulders and the cervical columns were moved to extension and contralateral rotation. Our clinical landmark for access insertion was a triangle with two borders (margins of sternocleidomastoid muscle) and the upper border of clavicle. After that the mentioned areas became sterile by betadine solution in width of 20 to 30 cm and covered by specific shun and 2 to 5 cc of lidocaine 2% was used for local anesthesia. In the non-tunneled group, we used needle (G 21) and approached to jugular vein through the apex of triangle with angle of 45 degrees (aspirate condition), then penetrated the jugular vein and leaded the needle toward ipsilateral nipple. After entering Jugular vein, we detached the needle from syringe and kept it there as a guider. Parallel to the previous needle, we used another needle (G 17) to enter the jugular vein and after entering it successfully, inserted a guide wire with length of 10 to 15 cm inside the mentioned vein gently. After that, we ex-

pelled both needles, dilated its entrance by a dilator, and inserted the accesses that were moisturized with normal saline through the guide wire into the jugular vein. Finally, we released the guide wire, washed lumens of the access with normal saline several times, and filled it with heparin (5000 unit per cc) and fixed it there by silk (size:00). At the end, after application of mupirocine ointment at the entrance site, it was dressed dryly.

### *Tunneling Method*

At first, lidocaine was injected subcutaneously towards posterior aspect of neck (5 centimeters). After entering guide wire into Jugular vein and dilatation of its lumen, we passed a needle (G 17) approximately 5 centimeters behind the entrance point through subcutaneous tissue and then exited it at the entrance point of guide wire. Then, we put the rest of the guide wire beneath the skin through mentioned needle. Subcutaneous way was dilated then by a dilator. The mentioned access was inserted into the tunnel through guide wire and leded towards jugular vein from the apex of triangle (figure 1). Finally, we released the guide wire and washed the lumen of the access by syringe (10 cc) several times and filled it with heparin (5000 units per cc) and then closed and dressed it, as the same as previous method.

Data analysis was done by SPSS (12<sup>th</sup> version) and expressed by mean and variance. "t" and "levene" tests were used for comparing of variances, and Kaplan-Mayer test for survival

analysis. To control of the last test, we used Log Rank test.

### **Results**

One case out of 30 selected patients was eliminated because of poor cooperation. Statistical information of 29 cases is demonstrated in table 1. Age, duration of catheterization, and length of neck were similar in both groups (table 2). Nine cases out of all subjects had fever before catheterization; Pearson's test was used for determination of relationship between lifetime of catheter and fever. There wasn't any statistical relationship between these two parameters in both groups ( $P=0.49$  and  $0.24$  in tunneled and non tunneled groups, respectively), (table 3). Four cases (28.6%) in the tunneled group and three cases in the non-tunneled group (20%) had bleeding at entrance site that was controlled by simple packing. In both groups, the most common reason for devoting catheter was fever (76.6% and 80% in tunneled group and non-tunneled groups, respectively;  $P=0.13$ ) (table 3). In all febrile patients, fever had stopped by removing of catheter. In the rest of the cases there was no need for catheter due to AVF maturation. Mean lifetime of catheter in the tunneled and non-tunneled groups were  $6.71 \pm 0.9$  and  $4.53 \pm 0.8$  weeks, respectively; this difference was significant statistically between two groups. ( $p$ -value= $0.0017$ ) (figure 2). Weibull's curves forecast the chance of accesses failure in the both groups, equally. (figure 3).

**Table 1.** patients profile.

	No	Min	Max	Mean	SD
Age(year)	29	16	73	51.06	15.05
Time of catheter insertion(m)	29	12	25	17.97	2.99
Cervical length (cm)	29	11	20	14.10	1.86

Min: minimum, Max: maximum, SD: standard deviation, m:minute

**Table 2.** patients profile according to tunneled and non – tunneled groups.

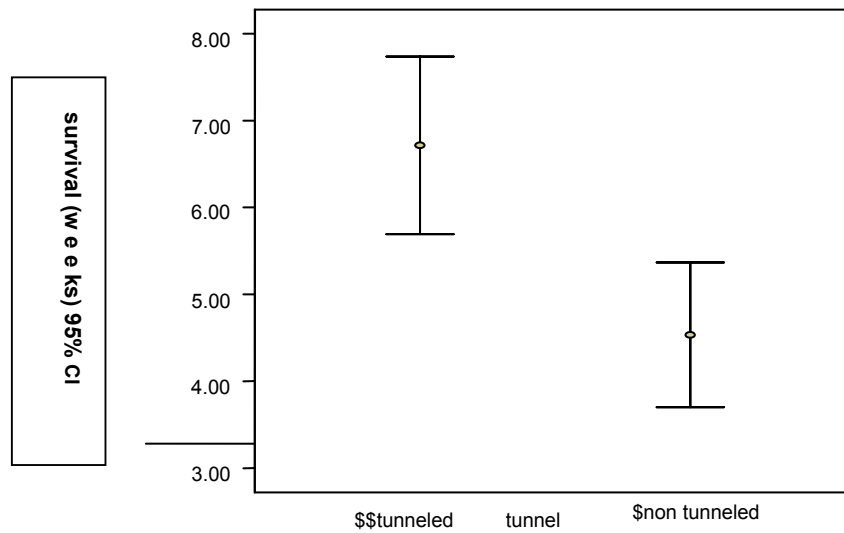
	Group	N	Mean	SD	P-value
Age(year)	Tunneled	14	49.37	15.37	0.56
	Non tunneled	15	52.66	15.10	
Time of catheter insertion(m)	Tunneled	14	17.71	3.41	0.67
	Non tunneled	15	18.20	2.56	
Cervical length (cm)	Tunneled	14	13.92	1.54	0.63
	Non tunneled	15	14.27	2.15	

SD: Standard deviation, m:minute

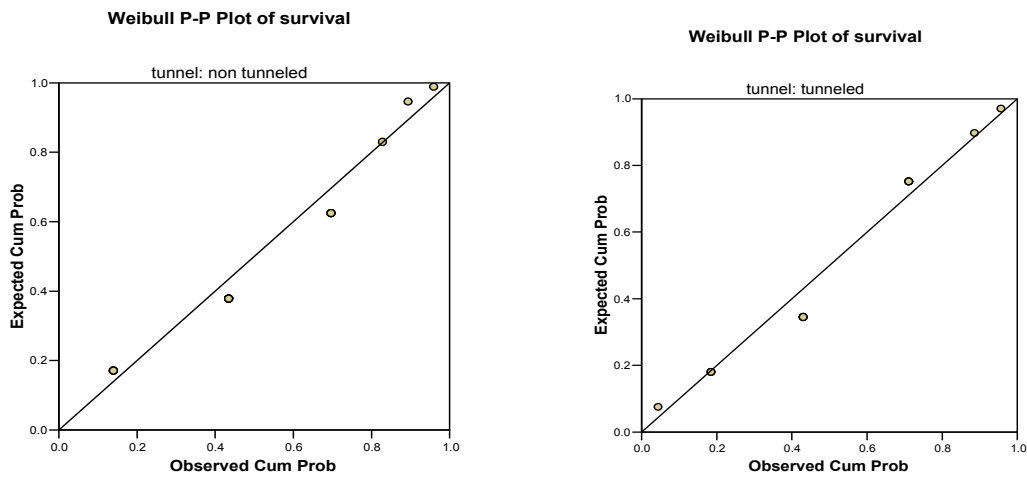
**Table 3.** complications before and after catheter insertion.

	Tunneled( %)	Non tunneled(%)
Presence of fever before procedure	4 (28.6)	5 (33.3)
No complication	11 (71.4)	12 (80)
Entrance site hemorrhage	3 (28.6)	3 (20)
Entrance site infection	2 (14.3)	2 (13.2)
Catheter related fever	11 (78.6)	12 (80)
No more need	1 (7.1)	

**Figure 1.** Subcutaneous tunnel is shown with arrow.



**Figure 2.** Catheter survival in tunneled versus in non-tunneled cases.



**Figure 3.** chance for accesses failure.

**Discussion**

National Kidney Foundation Dialysis Outcomes Quality Initiative (NKF-DOQI) emphasized on insertion of arterio-venous fistula for the patients with chronic renal disease as early

as diagnosed. In 65% of cases, temporary catheter is used <sup>10</sup>. Two percent out of these cases will face complication during temporary catheterization <sup>11</sup>. Brueck M et al reported that temporary catheterization have been com-

pletely successful with just 6% of complication. In their study, mean time of operation for inserting the temporary catheter was  $38 \pm 2$  minutes<sup>12</sup>. In our study, bleeding of entrance point was the only complication that could be seen in 20% of all cases. However, the mentioned percent of this complication is not reliable, regarding the low number of our cases. In this study, mean time of operation for inserting the temporary catheter has been 17.7 and 18.2 minutes for tunneled and non-tunneled groups, respectively; there wasn't a statistical difference between two groups ( $P=0.67$ ). There was no statistical difference in length of neck between the mentioned groups (13.9 cm for tunneled and 14.29 cm for non-tunneled group, with  $p$ -value = 0.63). It seems that the mentioned factor had not been effective on the mean life time of catheter and related complications. In another study by S. Abdol-Rahman and his cooperators, risk of infection with gram negative bacteria in temporary catheterization have been higher than in permanent catheterization and arterio-venous fistula (the most common agent was S-epidermis about 50%)<sup>13</sup>. In our study, infection was the most

common cause of access loss (76.6% in tunneled group and 80% in non-tunneled groups,  $P=0.13$ ); According to the  $p$ -value, there was no statistical difference between two groups and fever was interrupted as early as releasing the catheter. Mean life time of catheter in tunneled and non-tunneled groups were  $6.71 \pm 0.9$  and  $4.53 \pm 0.8$  weeks, respectively; this difference between two groups was statistically significant ( $p$ -value= 0.0017). Overall, mean survival of catheter in tunneled method was higher than in non-tunneled one, that represents cost effectiveness, less complication, and higher mean life time of catheter in the tunneled method. Considering that other parameters such as fixation of access at the entrance area were not considered, it needs to more studies must be designed to explore advantages and disadvantages of the suggestive method.

In summery, it is concluded that subcutaneous tunneling during temporary catheterization can increase its survival, and reduce subsequent dangers and related costs due to repeated catheterization with respect to routine method.

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